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THE TECHNIQUE OF RANDOMIZATION IN FIELD WORK

BY GEOFFREY BEALL,

Dominion Entomological Laboratory, Chatham, Ontario

Field workers are frequently faced with the necessity of making some sort of randomization. Thus randomization is today one of the conditions of trials in plots of, say, fertilizers or insecticides. Again, randomization is often attempted in sampling work, as when the number of insects in a plot or a field is to be ascertained from an incomplete examination; generally, when not attempted, it is by omission on the part of the investigator. These two major problems of randomization and other possible minor problems can, theoretically, all be solved mechanically by shuffling cards, throwing dice, etc. In fact, such mechanical solutions are often imperfect and, what is perhaps more serious, most laborious. Since, however, there exists a superior and lighter alternative procedure, i.e., randomization from tables, which does not seem to be used to full

7237	2685	2603	3236
8014	9841	2338	2625
4503	0448	1390	5287
1482	9373	7623	228
2843	7984	3475	649
8579	1486	7767	661
1682	7904	1964	53
3242	6914	8478	66
9652	4017	8044	1
4413	6317	8842	4
9176	7353	6564	
5390	0749	814	
6243	3435	33	
3451	3267	3	
4126	471		
3958	15		
0540			
85			

Table I.—A Series of Numbers Similar to Those Appearing in the Tract, *Random Sampling Numbers*

advantage by all field workers, the present paper has been written as introduction to such tables.

To date, three tables of random numbers have been prepared of which the earliest, by Tippett (1927) *, is perhaps still the most convenient. In the preparation of this work, the author probably had in mind, preeminently, theoretical studies on the distribution of statistical values but the table is as well suited for the present purposes of field work.

In order to illustrate the use of Tippett's table, a series of numbers similar to those appearing in the *Random Sampling Numbers* is shown in Table I. Such a series of figures would be found if one tore the corner off a page of the table of random numbers. In Table I, each digit is independently a random

* Tippett, L. H. C. 1927. Random sampling numbers. Tracts for Computers, No. XV, Cambridge University Press, pp. viii + 26.

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number, although the digits are broken up into columns of four in order to facilitate reading. Accordingly, if it is necessary to secure a randomization of the numbers 1 to 6 one has only, say, to read down the first column, omitting numbers greater than 6, and get the sequence, 4, 1, 2, 1, 3, 4, 5, 6, 3, 4, etc.; with equal justice one might choose to read, say, across the third line and get 4, 5, 0, 3, 0, 4, 4, 1, 3, 5 etc. Suppose, now, that it is required to arrange randomly 6 treatments, then by using the first sequence given above and dropping repeated digits one gets the order 4, 1, 2, 3, 5 and 6. These numbers can be written in order on the plan of a block, thus in Figure 1 they are written from left to right on a block, 3 plots wide and 2 plots deep. Of course, the actual treatments can be associated arbitrarily with the foregoing treatment numbers.

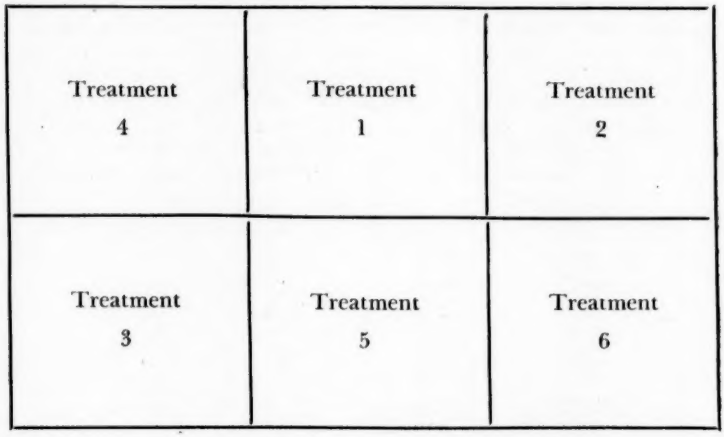


Fig. 1. An example of a block with 6 treatments randomly placed.

Random Sequences		Randomization for one plot	
Row	Hill		
7	11	1	4
4	12	1	10
1	10	1	12
2	6	2	6
7	11	3	4
7	8	4	12
1	4	7	8
3	4	7	11
1	12		
3	5		
4	3		
	etc.		

Table II.—An Illustration of the Randomization of Choice of Hills in a Plot

The use of Table I is not limited to randomization only of numbers with one digit, for if one wishes to get a random arrangement of numbers with 2 digits it is only necessary to consider the random numbers in pairs and thus read the first columns of Table I as 72, 80, 45, 14, etc. By a similar convention one can get a random arrangement of numbers of 3 figures also.

As an illustration of randomization in sampling suppose one is concerned with an experiment on some crop where it is necessary to examine 8 hills from a plot of 7 rows each 12 hills long. Then, one draws a sequence of random numbers (not shown in Table I) from 1 to 7, which represent randomly chosen rows, as shown in the first column of Table II; against these values one next places a sequence of random numbers from 1 to 12, representing hills. These two columns, read together, now give a sequence of randomized positions in the

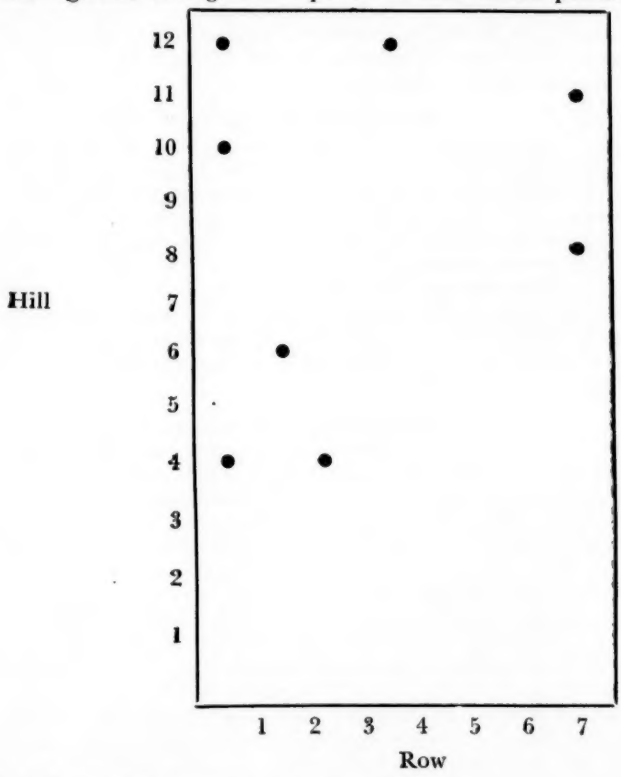


Fig. 2. The plan of the randomization shown in Table II.

plot and this sequence may be extended to any length. For any one plot, however, it has been supposed that a sample of 8 hills is to be taken, so it will be necessary to take the first 8 items of the sequence which has been obtained and so get 8 randomized positions for this plot. If this is done with the values of Table II it will be seen that the position (7, 11) occurs twice so that it will be necessary to discard the repetition and take one more randomized position, i.e., (1, 12). The eight positions can now be rearranged in order as in the third and fourth columns of Table II. Each subsequent plot will be randomized afresh in the same way. The writer has for some years prepared such randomizations on cards which are distributed to labourers who make the counts.

The randomization for the plot shown in Table II is illustrated in Figure 2.

The foreword to the table of *Random Sampling Numbers* deals with their use at length and simple ingenuity will find a method of use appropriate to almost any problem of randomization. The present discussion, it is hoped, will draw the attention of those engaged in field work to the possibility of carrying out theoretically perfect randomization with less concern and labour than is required for faulty methods.

SOME NEW MYCETOPHILIDAE*

BY FRANK R. SHAW,

Amherst, Massachusetts

In classifying several collections of Mycetophilidae I have found six species which appear to be new. In addition I wish to report two interesting variations in wing venation which I observed.

Bolitophila bucera n. sp.

Male: Length 6 mm. General color brown. Head brown. First two antennal segments and basal half of third yellow. Remainder of antennae brown covered with conspicuous white spines. Palpi and mouthparts dark brown.

Thorax uniformly brown. No markings present. Wing 6 mm. long. Sc_2 ends opposite base of R_s. R_4 ends in R_{1+2}. Stigmal spot present but faint. M-cu crossvein greatly reduced.

Legs: Coxae yellow. Remainder of legs dark brown. Abdomen dark brown. Hypopygium as in figure 1. This species seems to resemble *B. duplus* Garrett. The details of the hypopygium do not seem to agree with his description. Described from a single male taken at Boyer, Oregon, January, 1933, by James Macnab.

Mycetophila subquatuornotata n. sp.

Male: Length 4½ mm. General color yellow and dark brown.

Head dark brown. Antennae and palpi yellowish brown.

Thorax brown. Humeri yellow. Posterior angles of mesonotum yellow. A short, narrow yellow strip at posterior margin of mesonotum continuing to the scutellum. Lateral margins of scutellum dark brown. Scutellar setae six. Wing 4 mm. long. A dark brown spot covers R_s, distal 2/3 of r-m and the fork of M. A brown band from the tip of R_{1+2} beyond Cu_1 being broken in cell M_2.

Legs: Coxae, trochanters and femora yellow, the tips of the femora are dark brown. Tibiae and tarsi brownish yellow. Mesothoracic tibia with one spine on the flexor surface. Two rows of spines on the extensor surface of the metathoracic tibia.

Abdomen yellow. Dorsum of each segment with a large brown spot at the base. Posterior margin of each segment yellow. Hypopygium is in figure 2.

This species seems to be closest to *Mycetophila quatuornotata* Loew which was described from a female. In her thesis, Miss E. G. Fisher figures the hypopygium of what she believes to be *M. quatuornotata*. My specimen differs from hers in structure of both the inner and outer disti-styles. Described from a single specimen taken at Sherwood, Oklahoma, June, 1937, by Standish and Kaiser. Type in my collection.

Mycetophila thioptera n. sp.

Male: Length 4½ mm. General color yellowish brown.

Head brown. First two antennal segments yellow. Remainder of an-

*Contribution from the Department of Entomology, Massachusetts State College, Amherst, Massachusetts.

PLATE IV.

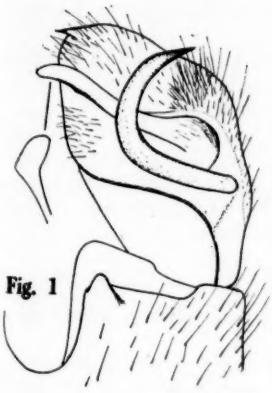


Fig. 1

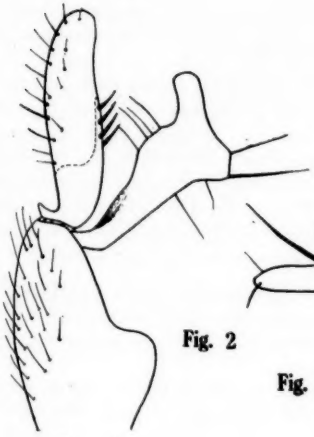


Fig. 2

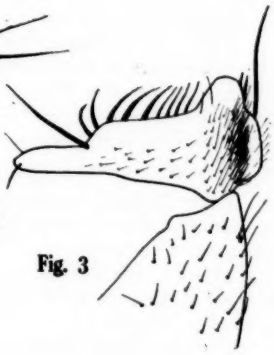


Fig. 3

Fig. 4

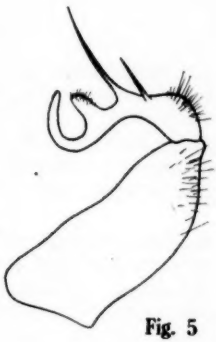


Fig. 5

Fig. 8

Fig. 9

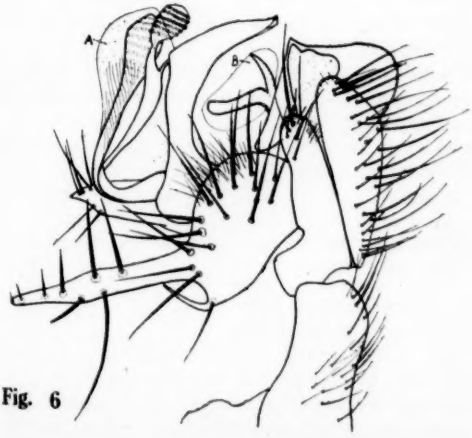


Fig. 6

Fig. 7

NEW MYCETOPHILIDAE

tennae and palpi brown. First joint of palpus small, remaining three greatly enlarged and flattened.

Thorax yellowish brown. Mesonotum somewhat darker than rest of thorax. Wing 4½ mm. long, unmarked but with a yellowish tinge—r-m crossvein longer than petiole of M.

Legs yellow. Mesothoracic tibia lacking spines on the flexor surface. Tow rows of spines on the extensor surface of the metathoracic tibia.

Abdomen light brown. Hypopygium yellow. as in figure 3.

This species most closely resembles *Mycetophila fungorum* variety *obscura* Fisher. It differs in the structure of the dististyle and the number and arrangement of setae on the dististyle. Described from two males taken at Page and Sherwood, Oklahoma, June, 1937, by Standish and Kaiser. Type in my collection. Paratype in Massachusetts State College Collection.

Mycomyia kiamichii n. sp.

Male: Length 4 mm. General color yellow.

Head brown. Palpi and first two antennal segments yellow. Remainder of antennae brown.

Thorax yellow. Mesonotum with a dark brown stripe above the base of each wing. Humeri yellow. Scutellar setae four. Wing 4 mm. long. Sc_2 ends proximad of middle of cell R_1. Petiole of M about 1 1/3 times as long as vein M_3. Cu forks slightly distad of the base of the r-m crossvein.

Legs: Coxae, femora and trochanters yellow. Tibiae and tarsi dusky. Mesothoracic coxae lack spurs.

Abdomen yellow. A narrow dark brown band present at the tip of each of segments 1-5. Remainder of abdomen brown. Hypopygium yellow as in figure 4.

This species most closely resembles *Mycomyia tantilla* Loew but differs in thoracic markings and the structure of the hypopygium. Described from one male taken at Flint, Oklahoma, June, 1937, by Standish and Kaiser. Type in my collection.

Phthinia catawbiensis n. sp.

Male: Length 7 mm. General color light brown.

Head brown. First two antennal segments yellow. Remainder of antennae, palpi and mouthparts light brown.

Thorax uniformly light brown. Wing 4 mm. long. Costa extends 1/3-1/2 the distance from tip of R_5 to M_{1+2}. Sc ends slightly proximad of R_s. r-m crossvein shorter than the petiole of M. Cu forks slightly distad of the base of R_s. Anal veins well developed extending almost to the fork of Cu.

Legs yellowish brown. Basitarsus of prothoracic leg three times as long as the tibia. Tibial spurs black, one on prothoracic leg, one large and one small on the mesothoracic leg and two subequal in length on the metathoracic leg.

Abdomen brownish. Base of each of segments 3-7 with a narrow yellow band. Hypopygium, figure 5, yellow, resembling that of *P. tanypus* but differs in that there is one long and one short spur on the dististyle instead of two subequal spurs.

Described from one male collected by M. W. George at Smokemont, North Carolina, August, 1937. Type in my collection.

Trichonta hansoni n. sp

Male: Length 6 mm. General color dark brown.

Head dark brown. Palpi, first three segments of antenna light brown.

Thorax brown. Mesonotum light brown with 3 dark brown stripes. The posterior region of the mesonotum with a transverse narrow dark brown band; this extends and covers the dorsum of the scutellum. Margin of scutellum light brown. Scutellar setae six. Wing 5 mm. long. Sc joins R at a point 2/3

the distance from the humeral crossvein to the base of R_s. Cu forks slightly beyond the base of the r-m crossvein.

Legs: Coxae and trochanters yellow, the latter with a dark brown spot on the ventral, distal region. Femora, tibia and tarsi yellow.

Abdomen: Dorsum of segment one dark brown, segment two dark brown with a narrow yellow band at the tip of the segment. Remainder of segments brown with a narrow yellow band at the base and tip of each segment. Hypopygium as in figure 6. The portions designated as "a" and "b" are covered with membrane.

This species most closely resembles *Trichonta venosa* Staeger but differs in the structures of the hypopygium.

I take pleasure in naming this species for my friend John Hanson who has prepared these and other drawings for me.

Described from one specimen taken at Mt. Desert, Maine, June 16, 1935, by C. P. Alexander. Type in my collection.

Trichonta sagana n. sp.

Male: Length 4 mm. General color brown.

Head dark brown, palpi and first three antennal segments yellow. Remainder of antennae dark brown.

Thorax brown. Mesonotum with 3 dark brown stripes. Lateral stripes do not reach anterior margin so that the humeri are lighter in color. Median stripe does not reach the scutellum. Scutellar setae six. Wings 3½ mm. long. Sc joins R at a point 2/3 the distance from the humeral crossvein to the base of R_s. Cu forks under the base of the r-m crossvein.

Legs: Coxae yellow with a narrow brown band at the tip. Remainder of leg yellow.

Abdomen: Segments one and two uniformly dark brown. Remainder of segments brown with both the anterior and posterior margins light yellow. Hypopygium brown, as in figure 7.

This species resembles most closely *T. vulgaris* Loew. It differs in the details of the hypopygium. Described from one male taken by C. P. Alexander at the Witch Hole, Mt. Desert Island, June, 1935.

In addition to the species described two specimens were found of considerable interest.

One, a female of *Mycomyia imitans*, has an added element of the subcosta (figure 8) which forms a small cell above cell R_1. The second, a species of *Allodia* has lost the base of R_s as shown in figure 9. Both of the above mentioned specimens were taken in the White Mountains, August, 1935, by C. P. Alexander.

EXPLANATION OF PLATE

Figure 1. *Bolitophila bucera* n. sp. Right clasper.
Figure 2. *Mycetophila subquatuornotata* n. sp. Left clasper.
Figure 3. *Mycetophila thioptera* n. sp. Right clasper.
Figure 4. *Mycomyia kiamichii* n. sp. Left clasper.
Figure 5. *Phthinia catawbiensis* n. sp. Right clasper.
Figure 6. *Trichonta hansoni* n. sp. Right clasper.
Figure 7. *Trichonta sagana* n. sp. Right clasper.
Figure 8. Abnormal wing of *Mycomyia imitans*.
Figure 9. Abnormal wing of *Allodia* sp.
Drawings by J. F. Hanson.

VARIATION IN THE NORTH AMERICAN ODYNERUS (RYGCHIUM) DORSALIS (FABRICIUS) (HYMENOPTERA, VESPIDAE).

BY J. BEQUAERT,

Museum of Comparative Zoölogy, Cambridge, Mass.

Odynerus dorsalis, one of the largest of North American Eumenine wasps, may be recognized by the following characters.

Clypeus of female about one and one-third times as wide as long, the straight apical margin about one-fourth of the greatest width, with slight, blunt edges, the surface flattened medially and with scattering, medium-sized punctures; of male, slightly wider than long, the apical margin very slightly curved inward or almost straight, with the edges more prominent and sharper than in the female, the surface flattened medially and much more sparsely punctate than in the female. Interocellar area scarcely depressed, not furrowed. Vertex of female with a deep, transverse, sharply delimited, cup-shaped depression lacking in the male. Terminal hook of male antenna moderately long, finger-shaped, slightly curved, very bluntly rounded at apex, flattened beneath, but thick and equally wide throughout. Thorax stubby, but longer than wide; anterior slope of pronotum smooth, without pits or depressions; humeral margin nearly straight and with a fine, continuous carina; humeral angles little marked, obtuse; upper half of postscutellum transversely swollen and coarsely crenulate, narrowly divided medially; lower half vertical, mostly smooth and part of the concavity of the propodeum. Propodeum broad and long on the sides; dorsal lateral areas far apart, very coarsely striato-punctate; concavity broad and deep, mostly covered with fine, transverse striae; superior ridges obsolete, either rounded off or with a short, low, upper crest, separated from the postscutellum by a broad groove; inferior and lateral ridges obtuse, rounded off, not crenulate; lateral angles moderately prominent, bluntly and broadly triangular, sometimes scarcely marked. Head and thorax very coarsely, rugosely punctate. Abdomen stubby. First tergite evenly and broadly rounded off between the horizontal area and the basal slope, not angular in profile; cup-shaped seen from above, about twice as wide as long and as wide as second tergite; apical margin flat, broadly translucent; impunctate, except for a row of punctures in a groove along the extreme side margins. Second tergite wider than long, apically with a large transverse depression, more pronounced in male than in female; apical margin slightly raised, very narrowly translucent, but not lamellate; covered basally with minute, scattering punctures, which gradually increase in size and numbers posteriorly, the preäpical depression very coarsely punctate and often aciculate (particularly in the male). Second sternite evenly convex at base and with a median, longitudinal furrow; postarticular transverse groove finely ribbed. Remaining segments normal, moderately and fairly uniformly punctate. Legs normal, femora and tibiae slender. Terminal three segments of maxillary palpi subequal in length, together slightly shorter than the combined second and third. Pubescence short and sparse; no erect long hairs over preäpical areas of second and succeeding tergites. Length (head + thorax + tergites 1 + 2): ♀, 12 to 15 mm.; ♂, 9 to 12 mm.

In a few specimens, of both sexes, the short upper crests of the propodeum are stronger than usual and separated by deep notches from the postscutellum. As this does not seem to be correlated with other differential characters and, moreover, grades into the usual conditon, I regard it as an extreme intraspecific variation. These aberrant specimens are from Texas (Fedor; Lee Co.; Brazos Co.), Kansas (Manhattan), Utah (Salt Lake City) and Virginia (Dayton). They were usually taken with normal *dorsalis.* Some are colored like the typical form, others like var. *balteatus.*

O. dorsalis is most closely related to *O. annulatus* Say, which covers much the same territory. There are many structural differences, particularly in shape and sculpture of the clypeus, shape of terminal hook of male antenna, and legs (which in *annulatus* are short, with decidedly swollen tibiae and femora). *O. annulatus* occurs in a number of color forms, often closely paralleling those of *O. dorsalis*. Thus typical *annulatus* is homeochromic with *O. dorsalis* var. *stricklandi; O. annulatus* var. *arvensis* de Saussure, with *O. dorsalis* var. *balteatus;* and *O. annulatus* var. *firmus* Cresson, with typical *O. dorsalis*.*

The known distribution of *O. dorsalis* and its color variants covers southern Alberta, southern Ontario, southern Connecticut (New Haven), southern New York (Long Island and vicinity of New York City), New Jersey, Pennsylvania, Virginia, North Carolina, South Carolina, Georgia, Alabama, Louisiana, Tennessee, Arkansas, Ohio, Indiana, Michigan, Illinois, Iowa, South Dakota, Nebraska, Missouri, Kansas, Oklahoma, Texas, New Mexico, Arizona, Utah, Colorado, Wyoming, and Mexico (States of Jalisco, Vera Cruz and Hidalgo).

The habits were studied by C. Hartman (1905), D. Isely (1914), and P. and N. Rau (1918). The female digs a burrow, as a rule vertically in level ground, sometimes slanting or horizontally in a clay bank (as observed by myself at Columbus, Ohio, both for the typical form and var. *balteatus*). The burrow ends in one to seven cells, usually placed one above the other, and stocked with paralyzed caterpillars; the egg is suspended from a delicate thread. No chimney or turret is built at the entrance to the burrow. Although this is a very common wasp, I have never seen a stylopized specimen and none has been recorded in the literature.

O. dorsalis occurs in three main colors, as separated in the key below; but the extent of black, ferruginous-red and yellow varies considerably, sometimes producing intergrades, which must be placed arbitrarily. I have found fewer of these than I had expected.

1. Ground color black, with a few restricted ferruginous blotches, usually absent from mesonotum and second tergite. Yellow markings more or less developed, but never with lateral spots on second tergite ..... var. *balteatus.*

Ground color ferruginous-red, more or less blotched with black; second tergite always partly or mostly ferruginous; mesonotum wholly black or blotched with ferruginous ..... 2.

2. Yellow markings more or less developed, but never with lateral yellow spots on second tergite ..... typical *dorsalis.*

Yellow markings extensive; second tergite with small or large yellow lateral spots, either free or connected with apical margin; mesonotum usually black ..... var. *stricklandi.*

O. dorsalis typical form

Vespa dorsalis Fabricius, 1775, Syst. Entom., p. 367 (no sex; "America"); 1781, Spec. Insect., I, p. 463 ("in America boreali").

Odynerus crypticus Say, 1823, Western Quarterly Reporter, II, p. 81 (no sex; Arkansas).

Rygchium louisianum H. de Saussure, 1852, Et. Fam. Vesp., I, p. 106, Pl. XIII, fig. 9 (♀; New Orleans).

Odynerus (*Odynerus*) *iturbide* H. de Saussure, 1857, Rev. Mag. Zool., (2) IX, p. 276 (no sex; "les parties chaudes du Mexique.").

Odynerus (*Leionotus*) *iturbidi* H. de Saussure, 1875, Smiths. Misc. Coll., No. 254, p. 265, Pl. III, figs. 15-15a (♂; Valley of Mextitlan and Cordova, Mexico).

Fabricius' original description reads: " V. ferruginea, abdominis primo segmento macula nigra margineque flavo. Statura et magnitudo *V. uncinatae*

*The exact status of the several names found in the literature for color forms of *O. annulatus* remains to be worked out. In addition to those here used at least the following will have to be considered: *O. bairdi* de Saussure: *O. geminus* Cresson; *O. annulatus* var. *oslari* Cameron; and possibly *O. sulphureus* de Saussure.

(= *Monobia quadridens* Linné). Antennae nigrae, basi ferrugineae. Caput ferrugineum, vertice nigro. Thorax ferrugineus, ...acula dorsali nigra lineolisque duabus ferrugineis obsoletis. Scutellum ferrugineum. Abdomen ferrugineum, primo segmento macula cyathiformi nigra margineque flavo. Tertium (probably error for "secundum") segmentum macula magna dorsali artra. Alae fuscae. Pedes ferruginei." Although the type has not been examined by recent authors and may be lost, there can be no doubt that Fabricius described the ferruginous form of the species. H. de Saussure's *R. louisianum* is clearly the same from the figure and I am unable to separate that author's *O. iturbide*.

No structures are mentioned in Say's description of *O. crypticus*, but it applies better to the male of typical *O. dorsalis* than to any other wasp known from Arkansas: "Rufus; wings dusky; tergum trifasciate with yellow.—Body rufous, much punctured; vertex and origin of the antennae, black; antennae dusky at tip; thorax with a black spot before the middle; scutel bilobate with a longitudinal deeply impressed line; metathorax concave; wings dusky, paler at tip; tergum with three yellow bands, the anterior one widest and slightly emarginate before, the posterior one smallest and subconcealed. Length more than 2/5ths of an inch. The third band of the back of the abdomen is sometimes near the preceding band as to appear like a dilatation of it."

I have seen typical *dorsalis* from New York (Canarsie; Inwood), Virginia (Falls Church), North Carolina (Raleigh; Wenona; Lake Waccamaw; Salisbury), Georgia (Savannah; Bainbridge), Alabama (Mobile), Louisiana (Shriever; Sabine River), Texas (Austin; Dickinson; New Braunfels; Dallas; Fedor), Arkansas (Springdale), Ohio (Put-in-Bay; Columbus), Indiana (Winona Lake), Illinois (Chicago), Iowa (Ames; Mt. Pleasant), Kansas (Hays; Garden City), Nebraska (Lodgepole; Cambridge; Indianola), Oklahoma (Vinson), New Mexico (20 mi. N. of Las Vegas), Arizona (Palmerlee; Tucson), Colorado (Clear Creek, Jefferson Co.; Denver; Greeley; Boulder; Golden; Berkeley; Platte Canyon), Wyoming (Torrington), and Mexico (Guadalajara, State of Jalisco).

O. dorsalis var. **balteatus** (Say)

Rygchium balteatum Say, 1837, Boston Jl. Nat. Hist., I, pt. 4, p. 383 (♀; Indiana).
Monobia sylvatica H. de Saussure, 1852, Et. Fam. Vesp., I, p. 95, Pl. XV, fig. 7 (♀; "Brésil"; erroneous locality).

Say based his *R. balteatum* on both black and ferruginous specimens of *O. dorsalis;* but his main description was based on the black form: "Black, thorax and head varied with ferruginous; tergum (= abdomen) with a yellow band.—Body black, punctured; head ferruginous; region of the stemmata black: antennae black, first and second and half of third joints ferruginous: thorax with a broad ferruginous margin, including the scutel, and with more or less of ferruginous in the middle; anterior margin with a slender yellow line interrupting the ferruginous margin: wings black-violaceous: feet yellowish: thighs dusky at base: tergum, first segment impunctured, on the posterior margin a yellow band abruptly dilated each side; second segment slightly punctured at base, posterior indented, with large punctures, and dull ferruginous; remaining segments punctured. Length over four fifths of an inch." Of his three varieties, the first two were slight variants of *balteatus*: "Var. A. Behind the scutel a transverse, yellow, abbreviated line.—Var. B. Posterior margins of the terminal segments of the tergum, obsoletely ferruginous." But his third variety was typical *O. dorsalis*: "Var. C. The ferruginous color predominates having but a small portion of black on the thorax; the tergum is ferruginous with only a line of black on the first segment, and a triangle of black at base of the second segment; but the yellow band on the first segment is still visible though less obvious."

As I show elsewhere, de Saussure's *Monobia sylvatica* was apparently

based on a specimen of *O. dorsalis* erroneously labelled as to locality. His colored figure is a fair representation of the black variant *balteatus*.

I have seen var. *balteatus* from southern New York (Long Island, common; New York City; White Plains; Croton-on-Hudson), Pennsylvania (Alleghany Co.; Pittsburgh), New Jersey (National Park), Virginia (Falls Church), Ohio (Put-in-Bay; Columbus), Indiana (Winona Lake), Michigan (Midland Co.; East Lansing; State College; Romeo), Illinois (Chicago), Texas (Fedor), Utah (Logan; Provo; Salt Lake City) and southern Ontario (Pelee Id.) Notwithstanding occasional transitions to the typical form, it is on the whole northern in distribution; but in certain localities both forms occur together, apparently under the same ecological conditions. At Columbus, Ohio, I found them nesting side by side in the same clay bank.

O. dorsalis var. (or subsp.) **stricklandi** new

Female. Black, ferruginous-red and yellow. Ferruginous markings as follows: entire clypeus; interantennal spot (somewhat orange); lower inner orbits, filling ocular sinuses; upper two-thirds of cheeks; scape and base of flagellum; most of mandibles; most of dorsal area of pronotum; most of scutellum; a spot on upper mesopleura; sides of propodeum; most of femora; blotches of first tergite; much of second tergite, except black base and funnel-shaped or triangular median area (rarely ferruginous almost replaced by yellow); and most of succeeding segments. Yellow markings: medio-anterior area of pronotum, extending the whole width of humeral margin; tegulae, somewhat ferruginous medially; most of transverse welt of postscutellum; spots on dorsal areas of propodeum; tips of mid and hind femora; most of tibiae and tarsi, shading into ferruginous; most of dorsal area of first tergite, except for a median, semi-elliptical black spot, edged with ferruginous; broad apical margin and two lateral spots on second tergite, the spots large or small and either free or connected with the apical fascia (sometimes second tergite mostly yellow); apical margin of third tergite; and much of second sternite. Wings violaceous-black as in typical form.

Male. Similar to the female. Entire clypeus, interantennal spot and lower inner orbits yellow; most of the tergites margined with yellow; lateral spots of second tergite sometimes small.

In this form the mesonotum is usually black; rarely it is blotched with rufous.

Holotype, female, Medicine Hat, Alberta, August 13, 1939 (E. H. Strickland). *Allotype,* male, Manyberries, Alberta, August 11, 1939, (E. H. Strickland). Both at Mus. Comp. Zool. *Paratypes*: Wyoming: Torrington, male (G. B. Fairchild). Colorado: Denver, male (J. Bequaert); Boulder, four males, bred from nest (Chas. H. Hicks). South Dakota: Cape, female (H. C. Severin); Hot Springs, three males (H. C. Severin). Nebraska: Ashland, male (D. S. Bullock).

The South Dakota specimens are much more extensively yellow than the others, resembling *O. sulphureus* de Saussure. The other specimens are homeochromic with typical *O. annulatus*... Both typical *annulatus* and var. *stricklandi* may occur together in the Upper Sonoran life zone.

ON SOME CHILOPODS AND DIPLOPODS FROM NORTH CAROLINA

BY RALPH V. CHAMBERLIN,
University of Utah, Salt Lake City.

In several small collections of myriopods recently made in North Carolina, and chiefly in the Duke Forest at Durham, by Mrs. Nelle Bevel Causey, and by her transmitted to me for identification, occur representatives of the species listed below. The purpose of the present paper is primarily to diagnose the several new forms represented; but because of the interest of some of the other records it seems desirable to give the complete list here as supplementary to the catalogue of forms previously known from the region. The types of the new species are retained in the author's collection.

CHILOPODA

Nampabius carolinensis Chamberlin. Several females were taken in a compost hole in the Duke Forest on December 7, 1939. It was originally described from South Carolina.

Bothropolys multidentatus (Newport). Three females of this common southeastern form were taken on Nov. 5 and 12, 1939 in the Duke Forest.

Paitobius zinus Chamberlin. One female was taken in the Duke Forest on December 10, 1939.

Sozibius tuobukus (Chamberlin). Two females were taken in the Duke Forest at Durham on December 17, 1939.

Pleurogeophilus varians (McNeill). Two specimens were taken in the Duke Forest on December 17, 1939. Mrs. Causey reports it to be relatively common there.

Linotaenia bidens (Wood). This is also a widespread southeastern species. A specimen was taken in the Duke Forest on Oct. 29, 1939.

Mecistocephalus maxillaris (Gervais). This widespread tropicopolitan species, common in the warmer parts of America, has not, so far as I know, been previously recorded as having been taken in the open in the United States, although it is occasionally found in hothouses. A number of specimens were taken by Mrs. Causey from a compost hole in the Duke Forest on December 7, 1939.

DIPLOPODA

Polydesmus serratus Say. Taken on Grandfather Mt., Linville, N. C., at an altitude of about 5000 ft., where it was abundant on Oct. 14, 1939.

Scytonotus granulatus (Say). Grandfather Mt., Linville, N. C., Oct. 14, 1939, and also not uncommon in the Duke Forest in the autumn of 1939.

Orthomorpha gracilis (C. Koch). This, the so-called "hothouse milliped", was found common in greenhouses at Durham all the year, but has not been taken there in the open.

Sigiria scorpio Chamberlin. A male was taken April 29, 1939, at Soco Gap Falls. The colors in life were noted to be as follows: "Dorsum dark brown with a red border completely around the collum and on the lateral and posterior margins of the tergites. Legs red." It was described originally from a station between Hot Springs and Paint Rock, N. C., where a male and female were taken by the author on Aug. 7, 1910.

Aporiaria carolina Chamberlin. Several males and females taken at Soco Falls, near Waynesville, Apr. 29, 1939.

Aporiaria geniculata Chamberlin. One male at the same locality and time as the preceding species. Also a male taken on Grandfather Mt., Linville, N. C., on Oct. 14, 1939.

Nannaria conservata sp. nov.

Male. A freshly moulted individual in which the entire body is still very pale.

The species is to be distinguished primarily by characteristics of the gonopods of the male. These conform closely in general form to those of *N. minor*, the genotype. As in that species the telopodite presents a thicker, subcylindrical division which narrows abruptly into a slender, acutely tipped, chitinous blade which curves mesad to meet the tips of the blade of the opposite gonopod; this blade bears about three ordinary setae proximally and just beyond this a thicker bacilliform seta, the distal portion of the blade entirely glabrous. The subcylindrical division is densely setose on mesal side to end; at its end a slender acuminate process projecting dorsocephalad, this process much shorter than in *N. minor*, only about equalling the thickness of the division and thus far shorter than the principal blade.

The sternal processes at bases of legs on segments immediately following the seventh are short and conical. The processes from coxae of second legs cylindrical and rather short.

The processes of the keels of the ninteenth tergite extending directly caudad, their ends convexly rounded; processes of other keels becoming more angular in going forward.

The body narrowed toward ends as usual, more strongly so at caudal end.

Length, about 19 mm.

Locality. North Carolina: Durham, the Duke Forest. One freshly moulted male taken Nov. 12, 1939.

Euryurus erythropygus (Brandt). A common form in the Duke Forest. Specimens recently examined were dated September 26, 1939.

Cleidogona caesioannulata (Wood). A common form in the Southeast. Specimens were taken in the Duke Forest on Oct. 18, 1939.

Tynopus gen. nov.

A genus seemingly closest to *Conotyla* but apparently a much smaller form differing in the notably fewer eyes, which are typically about 8 in number arranged in an angularly bent line instead of 16-20 in several series forming a triangular patch, and in the structure of the gonopods of the male. In the latter the anterior members are large and broadly laminate, while the posterior are slender chitinous blades extending well beyond the anterior laminae except distally. The ninth legs of the male are two jointed and clawless, but the joints are not inflated, being much more slender than in *Conotyla*.

Genotype. *T. dux* sp. nov.

Tynopus dux sp. nov.

Body and appendages nearly white in color.

The antennae relatively long; first four articles filiform but the fifth clavately much thickened, the sixth of about equal width; third and fifth articles longest, subequal.

Ocelli 8 in number, arranged in a series bent at right angles, one arm of four ocelli being transverse and the other longitudinal, the largest ocellus at the angle.

The keels well extended laterad, corners rounded and outer margin more or less convex, entire. Dorsal setae long and stout, arising from small tubercles.

The anterior laminae of the gonopods are broad and nearly parallel-sided to the apical portion which is rounded; a series of two or three setae in a line running from apex proximad. The posterior chitinous blades long, arising near mesal edge of the anterior laminae and distally curving caudad.

Ninth legs of male geniculate at junction of the two joints, the proximal joint very slender; the second thicker, slenderly clavate, subconically narrowed at apex, extending ectodorsad.

Length, about 3.65 mm.; width, .72 mm. Dorsal setae on keels close to .25 mm. long.

Locality. North Carolina: Durham, Duke Forest. One adult male taken Dec. 10, 1939.

Striaria causeyae sp. nov.

Body somewhat flattened above, the sides also somewhat flattened and so nearly vertical.

Second legs of male without processes beneath. The third legs of male with a long, slenderly subconical, slightly curved process from the coxa of each.

Head finely granular; purplish above and in the frontal and clypeal region with a triangular white spot between bases of antennae, a small white spot above this, and a white line over the sulcus of vertex. Antennae also purple, with first and last article paler.

Labrum at each outer corner with the usual conspicuous, sinuous spine. The interval between this spine and the median sinus, in which there are the typical three marginal teeth, moderately convex. Ocelli typically 7 in two series.

Differing from other known species, excepting *nazinta* Chamberlin of Oregon, in having twelve dorsal crests on the first tergite. The more dorsal or median of these crests extend from the caudal margin about two-thirds the distance to the anterior margin, the lower or more lateral crests extending farther. Lateral crest or keel flaring out nearly horizontally.

The dorsal crests on subsequent segments also twelve in number, extending entirely across metazonite and of nearly uniform height except at the ends which have a convex or rounded contour in side view. In the middle region the keeless, nearly vertical side between the outermost dorsal crest and the lateral crest is very wide, from three to four times the interval between two outermost dorsal crests. Lateral crests all flaring subhorizontally; more and more weakly developed in going caudad.

Last tergite with sinuses separating the three lobes wide open except at bottom where a very narrow cleft, with lobes contiguous much as in *californica.*

Length of male holotype, 12.5 mm.

Locality. North Carolina: Durham, Hillsboro Division of the Duke Forest. Five specimens taken 3 Dec., 1939, by Mrs. Nelle Bevel Causey, for whom the species is named.

Parajulus pennsylvanicus (Brandt). A specimen was taken Oct. 14, 1939, on Grandfather Mt. at Linville.

Diploiulus luscus (Meinert). Specimens of this common European form, now widely established in the United States, were found in a greenhouse in Durham at all seasons of the year.

Nopoiulus minutus (Brandt). Specimens of this European form, now widely established in the eastern and southeastern states, were found under the bark of a decaying tree, its favorite habitat, on Sept. 17, 1939, in the Duke Forest ,where it is reported to be occasionally found in large numbers.

Buotus gen. nov.

A genus of Polyzoniidae characterized by the short head, which is unusually broad above, the anterior occipital region rising conspicuously cephalodorsad in a transverse ridge over the lower part of head. Eyes one on each side as in *Siphonotus,* these directed forward. Antennae inserted rather close together and well below middle of head the lower part of which is not produced into a definite beak. Antennae strongly clavate, the fifth article abruptly much thicker and longer than the preceding articles.

Body having the general proportions of *Siphonotus;* cylindrical, with well developed, entire lateral keels; surface of body densely and very finely granular. Anal segment freely exposed from above. Segments numerous.

Genotype. Buotus carolinus sp. nov.

Buotus carolinus sp. nov.

Color whitish, uniformly granular throughout.

The antennae relatively large and distally heavy; evenly clavately widening from the narrow basal joint to and including the fourth; fifth article abruptly larger, twice or more the thickness of the fourth, widest at distal end, more than twice the length of the somewhat narrower sixth article.

The collum with anterior margin arcuate, the conspicuously convex median portion overlapping the occiput and fitting against its elevated anterior ridge; keels conspicuously projecting laterad, descending but little below the horizontal, lateral ends evenly convex: crossed by a median longitudinal sulcus continuous with similar ones on succeeding tergites.

The succeeding tergites are conspicuously elevated except adjacent to their anterior and posterior margins where they are much lower, the posterior low ring longer than the anterior, the result is that the body has a somewhat moniliform appearance.

Anal tergite longer than the penult, convexly rounded behind, the obtuse apex a little exceeding the anal valves; a large seta on each side of middle. Three shorter setae in a series on each anal valve along its mesal margin.

Number of segments in holotype, 28.

Length, about 4 mm.

Locality. North Carolina: Durham, the Duke Forest. One specimen, apparently a female, probably not fully grown.

NOTES ON THE GENUS PERONEA WITH DESCRIPTION OF A NEW SPECIES (LEPID., TORTRICIDAE) *

BY J. McDUNNOUGH,
Ottawa, Ont.

Since the publication of my revision of the North American species of this genus, the food-plants of the larvae of several species, at the time unknown, have been ascertained. The recording of these, together with a few other notes that have been made from time to time in the course of identification work, form the basis of the present paper.

Peronea maccana Tr. In my revision the differences between the genitalia of European specimens and those of our North American form, described under the name *fishiana* Fern., were considered to be too slight to warrant the retention of Fernald's name. Since then I have studied further European specimens (largely females) and more North American material. I now incline to the view that the two names should be kept separate and that my illustrations under *maccana* should be considered as representing *fishiana* Fern.

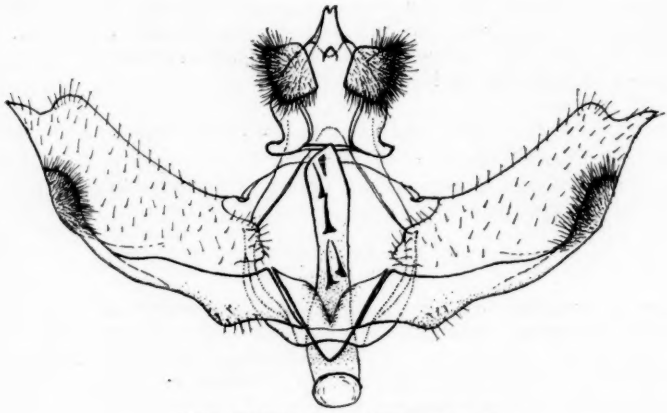
In the female genitalia of the true *maccana,* as can readily be seen by comparing Pierce & Metcalfe's figure with my own, the chitinized initial portion of the ductus bursae *does not extend below the cephalic margin* of the genital plate: it is followed by a short *weakly chitinized funnel-shaped portion,* beyond which it is membranous. In *fishiana (vide* my illustration) the initial chitinous portion of the ductus projects shortly beyond the plate and is not followed by any distinctly chitinized funnel-shaped portion, this section, while somewhat expanded, being largely membranous with only indications of irregular chitinization. Further the lateral lobes of the genital plate in *maccana* are shorter, more outwardly oblique and without a trace of the small terminal spine of *fishiana.* In the male genitalia differences are not so obvious and it has only been possible to examine a single European male of *maccana.* According to this specimen the apical section of the tegumen shows a much narrower and shallower median excavation and the lateral flaps are less evident. The apical

*Contribution from the Division of Entomology (Systematic Entomology), Department of Agriculture, Ottawa.

recurvation of the claspers is not so strong, resulting in a broader and shallower excavation of the ventral margin than is the case in *fishiana*.

Amongst the material before me I have found 3 females (Norway Bay, Que.; St. Godfroi, Que.; Edmonton, Alta.) which agree with European specimens of *maccana* and definitely established the occurrence of the species in North America; these all show a purple-brown suffusion over a gray ground color and the outer edge of the pale oblique antemedian band seems less rigidly oblique than in *fishiana*, especially in the cell; this feature is also noted in Kennel's illustrations of the European species. In *fishiana* the dark shading in the series before me from eastern and northern Ontario is predominantly red-brown, which was also the case with Fernald's type specimens from Maine.

Peronea caliginosana Wlk. A male specimen has been received from Fernie, B. C., bred from larva on *Alnus tenuifolia* by H. B. Leech.



Male genitalia of *P. okanagana* n. sp.

Peronea chalybeana Fern. A male was bred by T. N. Freeman from a larva found on *Acer* sp. at Fairy Lake, Que. (near Ottawa) and a female from a larva on *Corylus* sp. taken by F. P. Ide at Kazubazua, Que., north of Ottawa in the Gatineau region.

Peronea celiana Fern. A series of this species, together with its form *albilineana* Kft. was bred by me from larvae found on *Betula* at White Pt. Beach, N. S. Birch would seem to be its normal food-plant.

Peronea busckana McD. In consecutive years I bred a female and a male of this species from larvae found on *Spirea* sp. at White Pt. Beach and Petite Riviere, N. S.

Peronea maculidorsana Clem. In my description of the male genitalia in the revision I was in error in stating that the aedeagus is armed "with a short, apical spine". This is really a so-called "rose-thorn" in the vesica and does not belong to the armature of the aedeagus. I have bred the species in Nova Scotia from the following food-plants: *Kalmia* (3 specimens); *Chamaedaphne* (1 specimen); *Vaccinium* (1 specimen).

Peronea hudsoniana Wlk. A single male of this species was bred at White Pt. Beach, N. S. from a larva on *Populus tremuloides*.

Peronea bowmanana McD. A single female was secured from a larva on *Pyrus melanocarpa* at White Pt. Beach, N. S., during my insect survey in this region.

Peronea nivisellana Wlshm. A larva found on *Prunus pennsylvanica* at White Pt. Beach, N. S., produced a male imago of this species.

Peronea kearfottana McD. My drawing of the female genitalia is not quite accurate. Beyond its slightly chitinized portion the ductus bursae expands into a large membranous sack without bend or constriction; following this it narrows sharply, gives rise to the ductus seminalis and bends at right angles to terminate in the bursa.

Peronea fuscana B. & Bsk. In my illustration of the female genitalia the chitinized portion of the ductus bursae should be indicated as broadening distally into a bulb-shaped enlargement.

Peronea okanagana n. sp.

Palpi smoky gray, whitish inwardly. Head and thorax smoky gray. Primaries strongly rounded at base, light smoky gray with a very faint admixture of rusty scaling. A large and rather faint deep smoky gray triangular patch from costa at two-fifths to one-fifth before apex, extending inward to middle of wing and with blunt apex and somewhat lighter central shading. Scattered raised black dots over the wing, one in the fold near base, others principally on the dark costal patch, one row defining it inwardly and other rows crossing it obliquely and parallel to first row, the outer ones continued across wing in subterminal area as curved or oblique dotted lines. Traces of a dark terminal line. Fringes smoky gray. Secondaries dirty white with faint smoky reticulations in apical and terminal sections. Fringes whitish. Beneath primaries shiny gray with alternate light and dark dots on costa before apex; secondaries much as above. Expanse 17 mm.

Male Genitalia. Belongs in the *ferruginana* group with hood-like tegumen. Socii broadly attached to the sides of the tegumen, folded over and appearing in ventral view *almost squarely rectangular.* Sacculus with slight bulge on ventral margin near base and with well-developed apical hair-tuft. Claspers and aedeagus much as in *cornana* McD. Vesica with 4 *strong cornuti,* arranged more or less in a longitudinal row and with a *small, thin, triangular piece of chitin near apex.*

Holotype—♂, Shingle Cr. Road, Keremeos, B. C., June 8, 1935, (A. N. Gartrell); No. 5028 in the Canadian National Collection, Ottawa.

Paratype—1 ♂, same data.

The paratype lacks the darker costal triangular patch and is even gray with scattered black dots; the genitalia are similar, the shape of the socii being quite characteristic for the species.

RESEARCH NOTES

NOTES ON SOME RECENT ADDITIONS TO THE INSECT COLLECTIONS OF THE QUEBEC PLANT PROTECTION SERVICE

During the past summer the following observations were made on insects taken in the Province of Quebec and added to the collections of the Plant Protection Service, Quebec, Que.

Platysamia columbia Sm. Three specimens were taken at Quebec.

Achaetoneura samiae Webber. At least ninety-five per cent of the cocoons of *Platysamia cecropia* collected around Quebec during the fall and spring, 1937–1938, were parasitized by this tachinid.

Stilpnotia salicis L. An amateur entomologist collected fifty-one adults of this species at light at Beauport which is about three miles from Quebec; six larvae were taken on a Carolina poplar in a small park serving as a playing ground in the City of Quebec.

Xiphydria maculata Say. A number of specimens of this hymenopteron were bred from *Acer* at Quebec on June 9, 1939.

Elleschus bipunctatus L. This curculionid occurred very commonly on the flowers of *Salix.*

Casnonia pennsylvanica L. Taken at light; two specimens at Granby, June, 1939 (Mercier), and another at Montreal, June, 1939 (Mouget). These are the first records of this small carabid for the Province of Quebec.

Dircaea 4-maculata Say. This beetle was bred in large numbers from *Betula*.

Pisenus humeralis Kby. This species, a melandryid, was bred from a fungus growth found at the base of an oak tree.

Lasiotrechus discus Fabr. This small carabid was very numerous in the light traps at Granby, Que. (Mercier).

Tribolium confusum Jacq. Duv. was bred from a box of fish food purchased in a store in Quebec. It was found also in quantities in small samples of weed seeds.

Brachysomus echinatus Bonsd., a small curculionid, was obtained by sweeping low herbage growing on sandy and gravelly land near Yamachiche, Que., (Mercier). It was identified by Mr. W. J. Brown. This is an European species.

Brachyrhinus singularis L. This snout beetle was obtained by sweeping near Quebec. It was identified by Mr. Brown of Ottawa.

Tanysphyrus lemmae Fabr., another small curculionid, was taken in large numbers at light at Granby.

Pseudopachyta rugipennis Newn., a longicorn, was taken at Quebec by sweeping alder bushes. It was not very common.

Bolitophagus corticola Say. This medium-sized tenebrionid was taken at light at Granby on June 20, 1937 (Mercier).

Tomarus pulchellus Lec. was taken at light at Granby on June 11, 1939 (Mercier).

Pachybrachys hepaticus Mels. This chrysomelid was taken by sweeping low grasses on the Island of Orleans, July 25, 1939 (Morisset).

Colaspis brunnea suilla Fabr. This fine little chrysomelid was taken by sweeping at Granby on June 10, 1939 (Mercier).

Trogus quebecensis Prov. This large ichneumon was collected in the Lake St. John District on August 20, 1939 (Mercier).

Foxnax orchesides Newn., a melasid, was taken at light at Granby on July 6 (Mercier).

Ectopria nervosa Melsh. was taken in a light trap at Granby on July 16, 1939 (Mercier).

Prionocyphon limbatus Lec. was also taken in a light trap at Granby on July 6, 1939 (Mercier).

Ptilodactyla serricollis Say was collected at a light trap in Granby on July 4, 1939 (Mercier).

Macrocentrus amicroploides Vier. (determined by Muesebeck), a braconid, was reared at Quebec from the strawberry leaf roller, *Ancylis comptana* Frohl.

Macrocentrus cerasivoranae Vier. (determined by Muesebeck) was reared from *Homona fervidana* Wlk.

Apanteles hyphantriae Riley (determined by Muesebeck) was reared from *Hyphantria cunea* Drury at Quebec.

Pteromalus puparum L. (determined by Gahan) was reared from the chrysalis of *Papilio ajax* Linn.

Ormyrus ventricosus Ashm. (determined by Gahan) was reared from a gall on *Lactuca*.

Aulacidea podagrae Bass. (determined by Weld) was also reared from gall on *Lactuca*.

Phytomyptera lecuoptera Johns. was reared from *Homona fervidana* Wlk.

Argyrotoxa semipurpurana Kft. was bred from oak at Quebec.

J. I. Beaulne.

BOOK NOTICES

THE PRINCIPLES OF INSECT PHYSIOLOGY. By V. B. Wigglesworth. Methuen & Co. Ltd., London. Pages i–vii and 1–434; 316 illustrations. 1939. Price 30 shillings.

In this volume, Dr. Wigglesworth of the London School of Hygiene and Tropical Medicine has succeeded in bringing within the scope of one volume a well selected mass of information pertinent to insect physiology. Much of this information has been assembled from the results of investigations in divers fields of animal biology. Although Dr. Wigglesworth has made valuable original contributions to the literature on insect physiology, he has written the present volume without any apparent attempt to evaluate the work of others. The volume is concise, well written, and the material is presented in a logical manner.

Approximately the first 180 pages deal with the physiology of the insect as an entity. The volume begins with the development in the egg which is treated in an all too brief manner. This is followed by a chapter on the integument, including its chemical and physical properties, preparing the way for the chapter on growth. The next four chapters, dealing with the muscular system and locomotion, nervous system, sense organs, vision and mechanical and chemical senses, are logically followed by chapter viii on behaviour. The remaining chapters deal with respiration, the circulatory system and associated tissues, digestion and nutrition, excretion, metabolism, water and temperature, and reproduction. Each chapter has its own bibliography, the citations being referred to by small numbers. Each citation gives the author, source, year and a brief statement of the subject. (not the title). There is an adequate index which does not include the authors cited.

In 1934 Dr. Wigglesworth published, as one of Methuen's monographs on biological subjects, a small book of 134 pages—really a sketch—on insect physiology based on recent literature. The present volume of 434 pages is 'the masterpiece' built around the original sketch by the inclusion of new subject matter and detail drawn from the literature to date and giving the true breadth and perspective of the field.

As a source of information and a basis for further research, this volume should be indispensible to the entomologist. As the author states in his preface, "the physiology of insects is to some the handmaid of Economic Entomology. For although it is not the purpose of physiology to furnish directly the means of controlling insect pests, yet the rational application of measures of control—whether these be insecticides of one sort or another, or artificial interferences with the insect's environment—is often dependent on a knowledge of the physiology of the insect in question. Physiology may thus serve to rationalize existing procedures, or to discover the weak spots in the ecological armour of a species. A knowledge of the ecology of a species is always necessary to its effective control; its ecology can be properly understood only when its physiology is known."

R. H. Ozburn.

FLEAS OF EASTERN UNITED STATES. By Irving Fox, The Iowa State College Press, Ames, Iowa. 200 pp., 31 plates (166 figs.), Feb. 1940. Price $3.00.

This monographic work will indeed be welcome to taxonomists and other investigators concerned with the study of fleas and flea-borne diseases, especially as it is the first of its kind to appear since the publication in 1904 of Baker's revision of the American Siphonaptera. The author has performed a valuable service in collecting, organizing and bringing up to date the available knowledge on this important order of insects. The volume has an excellent cloth binding, and is compact, handy (6″ x 9″) and printed in clear readable type.

The text matter is admirably concise, well organized and logically arranged. The introduction includes brief statements on the collection and preservation, and life-history and control of fleas, and explanatory notes on morphology and terminology. This is followed by the taxonomic section which contains descriptions of 55 species with notes on their distribution in the Eastern United States, type locality and location of type where known, and eastern hosts. Keys are given to the suborders, families and genera. Only about one-fourth of the genera are represented by more than one species, and keys to these are provided in most cases. A notable exception is the genus *Ceratophyllus,* of which seven closely related species are included. The author states: "While the species are easily distinguished, the characters do not lend themselves well to a key." Nevertheless, the reviewer feels that this omission is unfortunate, and that careful analysis of the data should have enabled the author to construct a key that would have been of assistance in identifying the species concerned.

The book contains no new species, but includes two described by the author in 1939 in the Proceedings of the Entomological Society of Washington. In view of the publisher's statement that the volume contains the findings of the original research of the author carried on for more than three years at the United States National Museum and at Iowa State College, this dearth of new species seems rather surprising, and would indicate either that the eastern flea fauna has been very thoroughly worked over, or, more probably, that the material from this region available to the author for study was incomplete. In this connection, it is regrettable that the study was not extended to include material from Eastern Canada.

Other excellent features of the book are a synonymic index listing synonyms alphabetically, a host index in which the fleas that parasitize each host are specified, and a selected bibliography. In the case of the host index, exception may be taken to the abbreviation "etc." which is placed after several entries in the host list. This is a poor substitute for scientific names and, indeed, would appear to have no meaning and to serve no useful purpose, unless it is intended to indicate that the parasites may occur on other related host species which are not listed.

The distinguishing characters of the species are illustrated by 31 full-page plates comprising 166 figures. These are simple line drawings and on the whole appear to be adequate. The task of comparing the characters of different species would have been facilitated, however, by more uniformity in detail, scale and arrangement.

C. R. Twinn.

Mailed Wednesday, April 3rd, 1940.

GUELPH PRINTING SERVICE

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